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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/002,483	11/01/2001	Jeffrey W. Carr	RAPT-01000US2	2209

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EXAMINER	
OLSEN, ALLAN W	

ART UNIT	PAPER NUMBER
1792	

MAIL DATE	DELIVERY MODE
04/08/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/002,483	CARR, JEFFREY W.	
	Examiner	**Art Unit**	
	Allan Olsen	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 April 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,8-12,14-29 and 34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,8-12,14-29 and 34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 November 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10/19/2007*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 19, 2007 has been entered.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-6, 8-12, 14-29 and 34 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claims contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. Independent claims 1 and 34 each recite: “sustaining the plasma discharge through collisions between the excited precursor and the plasma gas”. The specification lacks support for the claimed “excited precursor". The specification discloses a process whereby the precursor efficiently disproportionates into reactive atoms, radicals and ions rather than simply becoming an excited state species having the same chemical structure as the precursor.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-6 8-12, 14-29 and 34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1 and 34 each recites the limitation "the excited precursor". There is insufficient antecedent basis for this limitation in these claims.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-6, 8-12, 14, 18-22, 24, 27-29 and 34 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent 5,000,771 issued to Fleming, Jr. et al. (hereinafter, Fleming).

Fleming teaches a method for shaping a surface of an optical preform. Fleming teaches using an inductively-coupled plasma (ICP) torch that has an outer tube to communicate a plasma gas to a distal end of the plasma torch and an inner tube nested within the outer tube to communicate a reactive precursor to

the distal end. As Fleming teaches forming a plasma by inductive coupling of RF energy from an antenna or coil Flemings plasma torch does not require an electrode. Fleming teaches translating the plasma torch (see figure 1 and column 8, lines 61-63). Fleming teaches a plasma sheath is formed between the distal

end of the torch and the plasma discharge (see figure 1-4). Fleming teaches introducing O_2 into the central tube and thereby teaches providing the reactive precursor to the plasma discharge through the inner tube to generate a reactive species in the plasma torch (see, for example, figure 1 and column 7, lines 4-14). Fleming teaches sustaining the plasma with collisions between the excited precursor and the plasma gas (column 4, line 53-column 7, line 14). Fleming teaches and shaping the workpiece surface by controlling a footprint of the plasma discharge from the plasma torch (see, for example, column 2, line 35 – column 3, line 39).

Fleming teaches the step of shaping the surface of the workpiece comprises removing material from the surface of the workpiece and causes minimal or no damage to the workpiece underneath the surface (see, for example, column 2, lines 14-34; column 3, lines 40-55; column 6, line 34).

Fleming teaches rotating the workpiece with respect to the plasma torch (see, for example, figure 1).

Fleming teaches a method wherein the plasma discharge and the reactive species are directed to a target portion of the workpiece (see, for example, figure 1).

Fleming teaches placing O_2, the reactive precursor, in the central channel of the plasma torch.

Fleming teaches using argon gas as the plasma gas (see, for example, column 7, lines 4-14 and column 8, line 55).

Fleming teaches controlling the mass flow of the reactive precursor into the plasma torch from between about 0 ml/min to about 2,000 ml/min thereby selecting a

concentration of the reactive precursor that is introduced into the plasma discharge (see, for example, column 7, lines 4-10 and column 8, lines 54-56; column 9, lines 10-12).

Fleming teaches coupling the RF energy to the plasma discharge in an annular region of the plasma torch (see for example, figure 1).

Fleming teaches controlling the size of the plasma discharge by selecting the inner diameter of an outer tube of the plasma torch (column 7, lines 1-3).

Fleming teaches introducing the plasma gas to the outer tube tangentially (see figure 1).

Fleming teaches metering the precursor and/or the plasma gas flow in the plasma torch (see, for example, column 7, lines 4-10 and column 8, lines 54-56; column 9, lines 10-12).

Fleming teaches maintaining the temperature of the plasma torch between 5,000 and 15,000 degrees C (see column 4, line 25).

Fleming teaches producing a volatile reaction product on the surface of the workpiece (column 3, lines 45-46).

Fleming teaches cleaning the surface of the workpiece with the plasma torch (c0olumn 7, lines 35-65).

Fleming teaches using a plasma torch with a multiple head to increase an etch rate of the plasma torch (column 6, lines 29-36).

Fleming teaches varying the precursor flow rate affects the etch rate of the plasma torch (column 7, lines 4-25).

Claims 1-6, 8-12, 14-17, 20, 23, 28, 29 and 34 are rejected under 35 U.S.C. 102(a) as being anticipated by Böhm et al in DE 199 25 790 A1 (hereinafter, Böhm).

Böhm teaches a method for shaping a surface of a workpiece, comprising: placing the workpiece in a plasma processing chamber including an inductively-coupled plasma (ICP) torch having an outer tube to communicate a plasma gas to a distal end of the plasma torch and an inner tube nested within the outer tube to communicate a reactive precursor to the distal end (see figure 1 and the following excerpts from the translation of record). In addition, Böhm teaches communicating the plasma gas to the distal end and generating a plasma discharge by transferring energy from a microwave power source to excite the plasma gas (it is noted that microwave is a subset region of the RF spectrum). Böhm teaches a plasma sheath is formed between the distal end and the plasma discharge. Böhm teaches introducing the reactive precursor to the plasma discharge through the inner tube to generate a reactive species in the plasma torch. Böhm teaches sustaining the plasma discharge through collisions between the excited precursor and the plasma gas. Böhm teaches placing the reactive precursor in a central channel of the plasma torch. Böhm teaches using argon as the plasma gas.

> The solving of this task is accomplished by using a device (plasma beam source), according to the invention, to generate, with the help of a microwave field, a highly reactive plasma beam of defined and scalable geometry and high density, which develops at the end of a coaxial microwave wave guide which is open to one side and which consists of an outer conductor and an inner conductor of appropriate geometry; whereby, the inner conductor of the coaxial conductor is constructed of two or more pipes having a suitable cross-section positioned concentrically to each other. Formation of the reactive plasma beam is effected, according to the invention, by diffusing a gas, which is supplied via an external pipe, into the plasma beam, which is formed through the interaction of an inert flow of gas with the microwave field, in such a way that the plasma beam is simultaneously provided with a temporally and spatially stable shape with an axial span ranging from a few millimeters up to a number of centimeters. This gas either contains the chemically reactive species or alternatively such a substance is generated in the plasma discharge from at least one of its components. An essential element of this solution, according to the invention, is that the highly reactive plasma beam does not

Böhm teaches the plasma torch includes an intermediate tube arranged between the outer tube and the inner tube and introducing an auxiliary gas into the intermediate tube to keep the plasma discharge away from the inner tube a central

> field at the end of a microwave wave guide, in which arrangement the inner conductor of the coaxial cable is designed in such a way that, in its interior, two or more reactive and / or inert working gases can be separately routed to the open end of the inner conductor, which functions as a nozzle. The effective cross-section between the substrate surface

> that the plasma does not enter into any kind of wall interaction other than with the substrate itself and, as a consequence, (1.) contamination of the plasma and thus the

> 18. Plasma source of Claims 1, 6, 7, 14, 15, 16 and 17, wherein the inner conductor of the above-mentioned coaxial microwave wave guide is constructed of two or more pipes positioned concentrically to each other, in such a way that a gap remains between each of the pipes through which the gas can flow. .
>
> 19. Configuration of Claims 1, 6, 7, 14, 15, 16, 17 and 18, wherein two or more gases or gas mixtures flow separately to the end of the above-mentioned coaxial microwave wave guide and emerge from this point.

Böhm teaches shaping the surface of the workpiece by controlling a footprint of the plasma discharge from the plasma torch and directing the plasma discharge to a target portion of the surface of the workpiece.

> The advantages provided by this invention consist of the following: a reactive plasma beam of high density and scalable dimensions (within certain limits) is generated in such a way that parasitic and thus generally disadvantageous, corrosive, plasma-wall interactions are avoided; with the help of this beam, flat, structured and even curved surfaces of conductive and non-conductive substrates with lateral dimensions widely ranging from millimeters up to meters can be precisely machined by the overlapping of the local effective cross-section with half-width values ranging from approx. 1 mm to

Böhm teaches translating at least one of the workpiece and the plasma torch. Böhm teaches rotating the workpiece with respect to the plasma torch.

> The shaping of the substrate through material removal is performed, according to the invention, as follows: the substrate, which is contained in a substrate holder preferably equipped with a substrate heating element, and the tool (plasma beam) are moved in relation to each other in a linear and/or rotating fashion at a speed which may be either constant or variable. This is performed in a vacuum container at a pressure ranging from 10 mbar to 1000 mbar; whereby, the relative motion between the substrate and the plasma beam source, which is, according to the invention, located in a pressure capsule in the same vacuum container, is affected through a computer-controlled movement system.

Böhm teaches the step of shaping the surface of the workpiece comprises causing minimal or no damage to the workpiece underneath the surface.

> The advantage of plasma processes as opposed to ion processes lies in the fact that the low kinetic energy of ions in plasma results in less damage being inflicted on layers near the surface; the energy of the ions in the plasma decreases as excitation frequency

Böhm teaches the step of shaping the surface of the workpiece comprises removing material from the surface of the workpiece.

> In certain circumstances it is expedient for this substrate shaping process to be effected by removing material through etching at higher substrate temperatures.

Böhm teaches metering the precursor and/or the plasma gas flow in the plasma torch. Böhm teaches selecting a concentration of the reactive precursor to be introduced into the plasma discharge. Böhm teaches controlling the mass flow of the reactive precursor into the plasma torch from between about 0 ml/min to about 2,000 ml/min.

Table 1 Typical Process Parameters

[Figure]

Parameter	Unit	Value
Pressure	mbar	100
Microwave energy	W	80
Gas flow Ar	sl/min	0.3
Gas flow SF_6	sl/min	0.3

Böhm teaches coupling the RF energy to the plasma discharge in an annular region of the plasma torch.

> within the vacuum chamber, as well as microwave generator (2) which is connected directly to the coaxial system. Supply (5) of the inert or reactive gases employed (Ar/He

> Source housing (10) contains microwave generator (2) and coaxial conductor (3a, 3b) which is sealed off from the treatment chamber by vacuum seals (13) and whose open end, which simultaneously functions as gas outlet (9), protrudes into the treatment chamber. Gas intake into the inner conductor of coaxial conductor (3b), depicted in the example as a double-walled pipe, is affected via supply connection (5). The source fill gas -- in this example air under atmospheric pressure -- is admitted through intake (12).

Böhm teaches using an auxiliary gas to adjust the position of the plasma discharge relative to the distal end.

> reactive plasma beam of defined and scalable geometry and high density, which develops at the end of a coaxial microwave wave guide which is open to one side and which consists of an outer conductor and an inner conductor of appropriate geometry; whereby, the inner conductor of the coaxial conductor is constructed of two or more pipes having a suitable cross-section positioned concentrically to each other. Formation of the reactive plasma beam is effected, according to the invention, by diffusing a gas, which is supplied via an external pipe, into the plasma beam, which is formed through the interaction of an inert flow of gas with the microwave field, in such a way that the plasma beam is simultaneously provided with a temporally and spatially stable shape with an axial span ranging from a few millimeters up to a number of centimeters. This gas either contains

Böhm teaches maintaining the processing chamber at about atmospheric pressure.

> 5. Process of Claims 1, 2, 3 and 4, wherein the process is performed at a process pressure of between 10 mbar and 1000 mbar in a container, specifically a treatment chamber.

> Source housing (10) contains microwave generator (2) and coaxial conductor (3a, 3b) which is sealed off from the treatment chamber by vacuum seals (13) and whose open end, which simultaneously functions as gas outlet (9), protrudes into the treatment chamber. Gas intake into the inner conductor of coaxial conductor (3b), depicted in the example as a double-walled pipe, is affected via supply connection (5). The source fill gas -- in this example air under atmospheric pressure -- is admitted through intake (12).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 15-17 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fleming as applied to claim 1 above and further in view of US Patent 6,218,640 issued to Selitser.

Fleming does not teach a torch comprising three nested tubes. Fleming does not disclose the pressure at which the plasma torch operates.

Selitser teaches a plasma torch comprising a plurality of concentric tubes. Selitser teaches providing a sheath gas to protect the central channel. Selitser teaches introducing the plasma gas tangentially (column 5, line 55 - column 6, line 15).

It would have been obvious to one skilled in the art to incorporate the nested tube configuration of Selitser because Selitser demonstrates that this provides an effective means of controlling the plasma discharge. By controlling the flow of gas through the different channels Selitser teaches that torch components can be shielded from the high temperature plasma. Selitser teaches the multi-tube torch provides a means of creating flow disturbance that results in more efficient mixing of gases and a more efficient coupling of plasma energy to the gases.

It would have been obvious to one skilled in the art to operate Fleming's torch at about atmospheric pressure because Fleming depicts a system that appears to be open to the atmosphere. Furthermore, Fleming does not disclose the use of vacuum equipment or a low pressure environment. Furthermore, Fleming uses very high flow rates for example (140,000 sccm) that would make it difficult to maintain a low operating pressure.

Claims 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Böhm.

In addition to the above noted teaching of Böhm, it is additionally noted that Böhm acknowledges the utility of the plasma torch for cleaning, polishing and planarizing substrates. Böhm teaches the method allows one to carry out precise

> The application focuses on the efficient generation of surface geometries, primarily of a precise, aspherical nature, which deviate substantially from the original geometry of the surface, through the reactive etch removal of material. From an economic point of view,

> (1988); pp. 82-97, Bollinger, et al.; "Predicted Polishing Behaviour of Plasma Assisted Chemical Etching (PACE) from a Unified Model of the Temporal Evolution of Etched Surfaces"; SPIE vol. 966 Advances in Fabrication and Metrology for Optics and Large
>
> Manufacturing and Testing (1990), pp. 2-14.; C. B. Zarowin, "Basis of Macroscopic and Microscopic Surface Shaping and Smoothing by Plasma Assisted Chemical Etching," J. Vac. Sci. Technol. B 12(6), Nov./Dec. 1994, pp. 3356-3362.; as well as the patent documents US 5,290,382, US 5,291,415, US 5,336,355, US 5,375,064, US 5,376,224, US 5,811,021]. The processes described in these documents use RF plasma as a tool,

Böhm does not explicitly teach using the plasma torch to clean, polish or planarize the surface of a workpiece substrate.

It would have been obvious and self evident, to one skilled in the art, to use Böhm's improved plasma torch for the same purposes for which plasma torches had previously been used.

Response to Arguments

Applicant's arguments filed January 9, 2008 have been fully considered and were found to be persuasive. Imahashi does not teach an ICP plasma torch having the nested tube configuration that delivers the precursor to the distal region of the torch.

Conclusion

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 571-272-1441. The examiner can normally be reached on M, W and F: 1-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Allan Olsen/
Primary Examiner, Art Unit 1792